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GFE TRANSLATION Co., Est'd 1971

HARRY JULICH, ENGINEER
6807 WINTER LANE
ANNANDALE, VA 22003
PHONE: (703) 354-0491
FAX: (703) 354-2269

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CERTIFICATION

I, the undersigned, am a professional translator, fully competent to translate from German into English, and I declare hereby that the attached English rendition,

DEVICE FOR ADAPTING AT LEAST ONE HEARING AID

is a genuine translation, accurate in every particular, to the best of my ability and knowledge, of the German text, also attached,

ANLAGE ZUR ANPASSUNG MINDESTENS EINES HÖRGERÄTES
[PCT/CH99/00355]

July 5, 2000

H. Julich
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Harry Julich

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DUPLICATE CANCELLED

DEVICE FOR ADAPTING AT LEAST ONE ACOUSTIC HEARING AID.

INS B1

The present invention relates to a device, hereafter apparatus, to adapt, hereafter fit, a hearing aid as defined in the preamble of claim 1.

Increasing the hearing-aid industry processes the audio signals digitally. At the near end of a process, a digital signal-processing unit transmits audio signals to an electrical/mechanical coupler of a hearing aid. The transfer function of the hearing aid between the acoustic/electric input transducer and the electric /mechanical output transducer is set up in such manner at the signal processing unit that the hearing aid shall extensively eliminate idiosyncratic hearing deficiencies.

It is probably obvious that such hearing aids can be optimally useful if -- usually stepwise -- first a coarse fitting is carried out and then, in situ, a fine one during which the hearing-aid transfer parameters are matched to idiosyncratic needs.

Typically coarse fitting is based on diagnostic data such as audiograms. At least part of the transfer parameters are fitted on the basis of such data in the hearing aid, or else the kind of hearing aid is selected first accordingly.

Then fine fitting is carried out in situ. Basically an individual to receive one or two hearing aids shall wear it (them) to be exposed to test auditory signals. Said individual is asked to report his responses to the test signals and fine fitting of parameters is then carried out accordingly.

It also follows clearly that manually fine-fitting the transfer parameters at the hearing aids while at the individual's ear is an impractical procedure if carried out manually, for instance by operating a potentiometer. Accordingly such hearing aids are equipped with an appropriate interface, namely a communication link to a fitting calculator, primarily to the communication system "computer to hearing aid".

In the simplest case, which however is not operatively the optimal one, the individual verbally informs an expert, such as a hearing-aid acoustician, of his rating of the audio test signal. The acoustician, following appropriate conversion, feeds data into an input device, usually a keypad, to the fitting calculator. This calculator determines/computes setpoints of electronic units of the hearing aid, said setpoints being transmitted by said communication link from the fitting calculator to the hearing aid.

Such operations, being based on verbal communication of the individual's response to audio test signals and the conversion into quantified inputs to the fitting calculator, require unusually well trained technical personnel.

To eliminate this problem and to design the in-situ fitting procedure to be as short and as rational as possible regarding the said individual, individual responses already have been standardized and hence no longer are transferred through the hearing-aid specialist to the fitting calculator, but instead are transmitted directly. For that purpose input units with simple key functions are used, which allow the individual to rate the perceived audio test signals for instance on a given scale. This input unit communicates directly with the fitting calculator.

In increasing manner, digital hearing aids are being fitted according to perceived psycho-acoustic values, namely loudness. Reference is made in this regard to the European patent document 0 661 906 A which corresponds to the US application 08/720,748 by this applicant. Illustratively these documents elucidate how the psycho-acoustic perceived value (loudness) can be rated according to a scale by an individual and how a calculator unit sets the hearing-aid transfer parameters caused by the response to stimulus for the specific, critical frequency bands of human hearing. This procedure is comprehensively discussed in the cited document and affects the present invention only in that it explains for instance how a fitting calculator determines transfer-function parameters based on the individual's rated statements of loudness.

INS B2
B3
INS B4
B5

Fig. 1 shows the presently known geometry of an apparatus for the in-situ fitting of one hearing aid, or, in the case of binaural fitting, of two. This apparatus on one hand comprises a fitting calculator unit 1 with a digital computer 3. The setpoints determined by the digital processing unit 3 are transferred through an interface 5 to the hearing aid 7 borne by the individual I, wherein they result in fine fitting the relevant transfer parameters. As indicated in schematic manner, the Individual I is subjected to acoustic test signals T and responds by grading the perceived stimulus on a rating unit 9. The grading result is transmitted to an interface 11 at the fitting calculator 1. The fine parameter matching is calculated by the computer unit 3 from these rating signals R and from the typically pre-known fitting history.

The present invention relates to the communications link between the fitting calculator 1 and the hearing 7 and the rating unit 9. The purpose of the present invention, as indicated schematically in Fig. 1, is to substantially simplify said apparatus. Accordingly this apparatus is characterized by the features of claim 1. Therein the first interface comprises a signal output to at least one hooked-up hearing aid and the second interface is combined with the first to receive individual response signals to audio stimuli.

Because critical safety requirements are placed on electro-medical interfaces transmitting electrical signals in situ to pertinent equipment, such interfaces are expensive, for instance including electric signal isolation. In this respect the rating unit 9, through less critical than the ear, also must be considered problematic, and therefore the design of the invention, namely to combine the two interfaces, which is comparatively expensive for these electro-medical safety requirements, offers the substantial advantage that both implements, namely the hearing aid and the rating unit, are optimally made safe.

The interface of the invention is bidirectional, that is, it must transmit signals from the computer unit as well as feed signals to it.

In a preferred embodiment of the invention, its interface unit is an I^2C unit and the communications links, on one hand to at least one hearing aid and on the other hand to the

rating unit is a two-line I^2C bus. This two-wire control bus technology is well known and at the present time is sold by Phillips Co.

However and illustratively, the communications link can be implemented by means of I^2S interfaces also sold by Phillips Co, in particular if expanded for two-way communications in the manner comprehensively discussed by the present applicant in its application WO99/13699.

According to claim 3, when the apparatus is operational, it comprises a rating unit for auditory-stimulation response signals, preferably in the form of a keypad, of a voice input, the rating input unit being connectable to the interface.

Even though the interface unit of the invention may be physically configured inside the fitting calculator and comprises one physical connection each for the minimum of one hearing aid and to the rating input unit, a preferred embodiment of the interface unit of the invention is in the form of a branching unit comprising at least one connection to the fitting calculator. one connection to a rating input unit and one connection to the minimum of one hearing aid.

The communication between the single interface unit and the hearing aid or the rating input unit shall be wired or wireless, where, in the latter case, the hearing aid shall include a receiver stage, the rating input unit shall include at least one transmitter and, appropriately, the transmitter and receiver shall be configured at the interface.

The invention is next elucidated in relation to another Figure which, based on Fig. 1, shows one embodiment of the apparatus of the invention.

Components already discussed in relation to Fig. 1 shall be identically referenced in the second Figure.

The invention provides a single interface 13 for the hookup both to the rating input unit 9 and the hearing aid 7, said interface 13 communicating in both directions with the computer unit 3 in the fitting calculator 1 and either releasing the rating input unit 9, to feed data into the computer unit 3, or the computer unit 3, to feed data into the hearing aid.

In a manner evident to the expert, Fig. 2 shows that the interface 13 of the invention in principle can be configured arbitrarily close to the computer unit 3; nevertheless and as shown by Fig. 2, the preferred embodiment is designed as a branching unit 15. Said unit 15 communicates through a first connector 15_3 with the computer unit 3, through a second connector 15_9 with the rating input unit 9, and through a third connector 15_7 with the hearing aid 7. In a further preferred embodiment of the invention, the communication between the interface 13 and the rating input unit 9 as well as between the interface 13 and the hearing aids $K_{15/9}$ or $K_{15/7}$ is implemented, as shown in Fig. 2, by I^2C buses, the interface 13 being designed as an I^2C interface at least with respect to said components 7 and 9. Corresponding I^2C interfaces are present at the components 9 and 7.

It is understood that all the cited communications links K, including those between the interface 13 and the computer unit 3, may be wireless, whether individually or in combination, with omitted transceivers mounted on the components 1, 15, 9 or 7. The computer unit 3 drives the interface 13 to generate, in time-sequential manner, communications between the rating input 9 and the computer unit 3 or between the computer unit 3 and the hearing aid 7.